

# **Accuracy Characteristics for ZTL Risk Reduction Scenario Hours 2000-2300**

## **1 Introduction**

This document contains scenario characteristics for hours 2000 to 2300 GMT recorded on October 11, 2000 at Atlanta ARTCC (ZTL). Characteristics to be provided are general statistics determined from the scenario on airspace characteristics, aircraft to aircraft and aircraft to airspace encounters, general air traffic, aircraft, and flight plan adherence. Definitions of the provided scenario characteristics are provided in Reference[1].

## **2 Reference**

[1] Paglione,M., Oaks,R., Ryan,Dr. H., Summerill,J.S., (Final, January 2000), *Description of Accuracy Scenarios for the Acceptance Testing of the User Request Evaluation Tool (URET) / Core Capability Limited Deployment (CCLD)*, FAA William J. Hughes Technical Center / ACT-250, Atlantic City, New Jersey.

NOTE – Section numbers in this document do not map to those of the reference document.

## **3 Center Airspace**

This section corresponds to Section 3.1 of Reference[1]. The below data corresponds to the ZTL Center using the October 11, 2000 ACES chart cycle. Information provided in Table 1 was gathered from running URET PRE and local knowledge.

**Table 1: Center Airspace Characteristics**

Metric	Definitions	Count
Airports	From URET DU Adaptation List	TBD
Sectors	From URET DU Adaptation List	TBD
SAA	Special Activities Airspace	TBD
APDIA	Automated Problem Detection Inhibited Area	TBD
SID	Standard Instrument Departure	TBD
STAR	Standard Arrival Route	TBD
PAR	Preferential Arrival Route	TBD
PDR	Preferential Departure Route	TBD
PDAR	Preferential Departure Arrival Route	TBD

## 4 Aircraft Encounter Distributions

The statistics collected in this section characterize aircraft to aircraft encounters. The encounter counts are partitioned by selected minimum horizontal separation intervals, a count of encounters partitioned by standard flight levels, and by vertical phase of flight and aircraft encounter angle. This section corresponds to Section 3.2.1 in Reference[1].

### 4.1 Count Partitioned by Minimum Horizontal Separation

This section corresponds to Section 3.2.1.1 in Reference[1].

**Table 2: Count of Current Plan Aircraft Encounters**

Min. Horz. Separation (nm)	Without Adherence	13 Minutes Adherence
$0 \leq d < 5$	243	148
$5 \leq d < 10$	310	165
$10 \leq d < 15$	478	237
$15 \leq d < 23$	927	449
$23 \leq d < 30$	823	393
Total	2781	1392

**Table 3: Count of Trial Plan Aircraft Encounters**

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
$0 \leq d < 5$	243	139
$5 \leq d < 10$	310	157
$10 \leq d < 15$	478	216
$15 \leq d < 24$	1066	469
$24 \leq d < 30$	684	308
Total	2781	1289

## 4.2 Count Partitioned by Altitude for Standard Separation Intervals

This section corresponds to Section 3.2.1.2 of Reference[1].

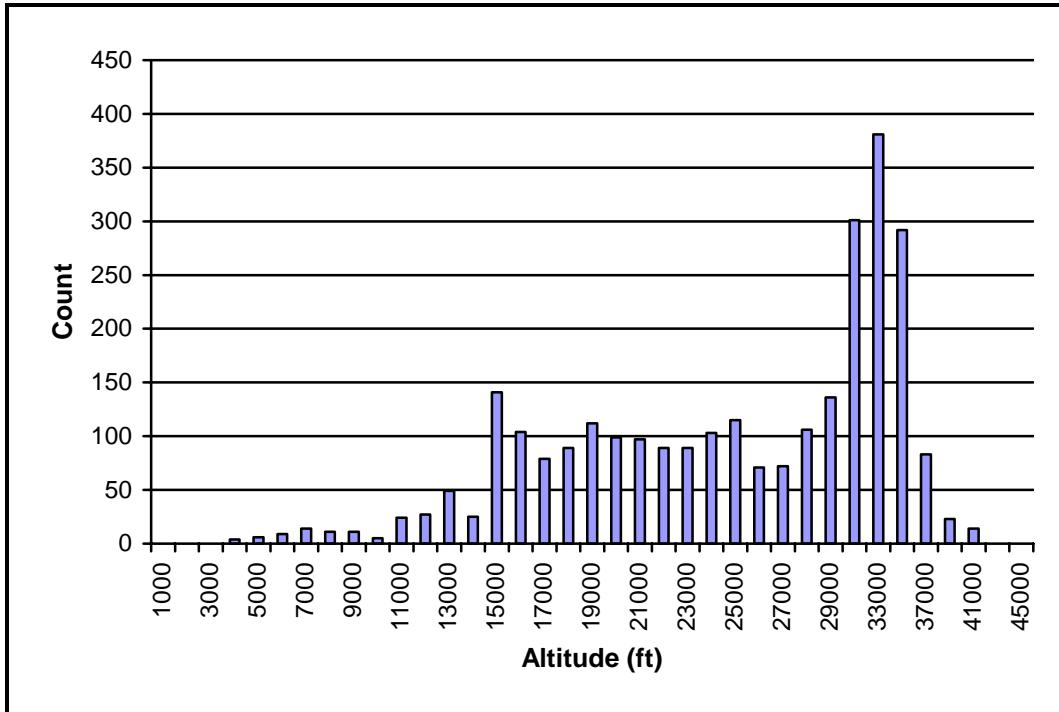


Figure 1: Aircraft to Aircraft Encounters by Altitude

## 4.3 Count Partitioned by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.1.3 of Reference[1].

Table 4: Count of Aircraft Encounters Partitioned by Phase of Flight and Encounter Angle

Vertical Phase	Encounter Angles (deg)				Total
	[0, 45)	[45, 90)	[90, 135)	[135, 180]	
Cruise-Cruise	71	67	86	36	260
Descend-Descend	112	26	15	12	165
Climb-Climb	224	45	38	29	336
Cruise-Climb	282	160	169	221	832
Cruise-Descend	197	161	145	199	702
Climb-Descend	91	61	77	223	452
Unknown	24	4	3	3	34
Total	1001	524	533	723	2781

## 5 Airspace Encounter Distributions

This section provides statistics on aircraft to airspace encounters. Three areas considered are counts partitioned by selected minimum horizontal separation intervals, an encounter count partitioned by standard flight levels, and a count partitioned by vertical phase of flight and airspace encounter angle. Additionally, vertical phase of flight count is separated into top, bottom and side airspace encounters and for encounters with unknown encounter angles. The section corresponds to Section 3.2.2 of Reference[1].

### 5.1 Count Partitioned by Minimum Horizontal Separation

The section corresponds to Section 3.2.2.1 of Reference[1].

**Table 5: Count of Current Plan Airspace Encounters by Horizontal Separation**

Min. Horz. Separation (nm)	Without Adherence	13 minutes Adherence
Conflicts <sup>1</sup>	81	57
$d = 0^2$	80	63
$0 < d < 7$	284	237
$7 \leq d < 9$	85	61
$9 \leq d < 11$	61	49
$11 \leq d < 16$	194	150
$16 \leq d < 30$	760	568
Total	1545	1185

**Table 6: Count of Trial Plan Airspace Encounters by Horizontal Separation**

Min. Horz. Separation (nm)	Without Adherence	20 minutes Adherence
Conflicts <sup>3</sup>	81	55
$d = 0^4$	80	62
$0 < d < 8$	326	262
$8 \leq d < 11$	104	81
$11 \leq d < 13$	71	61
$13 \leq d < 19$	277	207
$19 \leq d < 30$	606	442
Total	1545	1170

<sup>1</sup> This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

<sup>2</sup> This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

<sup>3</sup> This count includes encounters that are conflicts. By definition the minimum horizontal separation is zero and the track point actually penetrates the airspace.

<sup>4</sup> This count includes encounters without valid airspace penetrations, which occurs under two cases: a short duration penetration or an encounter on the actual buffered boundary of the airspace which does not penetrate.

## 5.2 Count Partitioned by Altitude

This section corresponds to Section 3.2.2.2 of Reference[1].

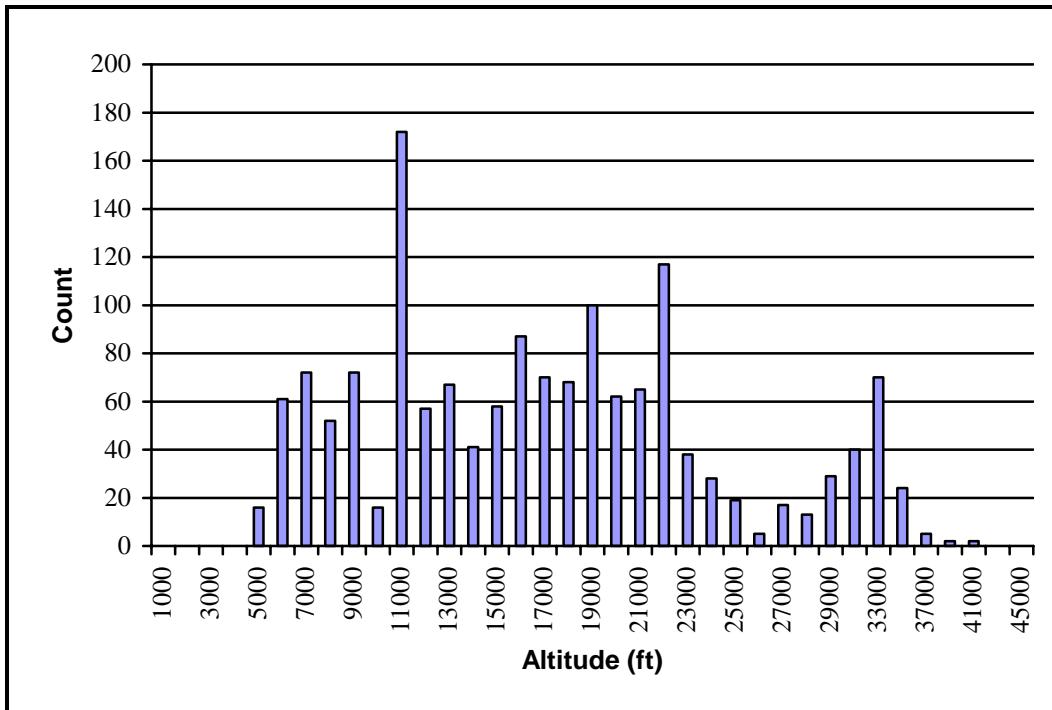


Figure 2: Airspace to Airspace Encounters by Altitude

### 5.3 Count by Vertical Phase of Flight and Encounter Angle

This section corresponds to Section 3.2.2.3 in Reference[1].

**Table 7: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Side Conflicts**

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	2	2	6	10
Cruise	6	11	15	32
Descend	2	2	4	8
Total	10	15	25	50

**Table 8: Count of Airspace Encounters by Angle and Vertical Phase of Flight for Top and Bottom Conflicts**

Vertical Phase	Encounter Angles (deg)			Total
	[0, 30)	[30, 60)	[60, 90)	
Climb	3	0	0	3
Cruise	0	0	0	0
Descend	7	0	0	7
Total	10	0	0	10

**Table 9: Count of Airspace Encounters by Vertical Phase of Flight with Unknown Angles**

Vertical Phase	Count
Climb	10
Cruise	9
Descend	2
Total	21

## 6 Air Traffic Distributions

This section provides metrics that characterize the air traffic. The metrics are flight density partitioned by standard flight levels, flight type and sector penetration, statistics on the number of active flights, ground speed statistics, counts of interim altitude and amendment messages, and air traffic maneuvers by altitude and phase of flight. This section corresponds to Section 3.3 of Reference[1].

### 6.1 Air Traffic Density

This section corresponds to section 3.3.1 of Reference[1]. Detailed statistics on aircraft encounters are provided in Appendix A.

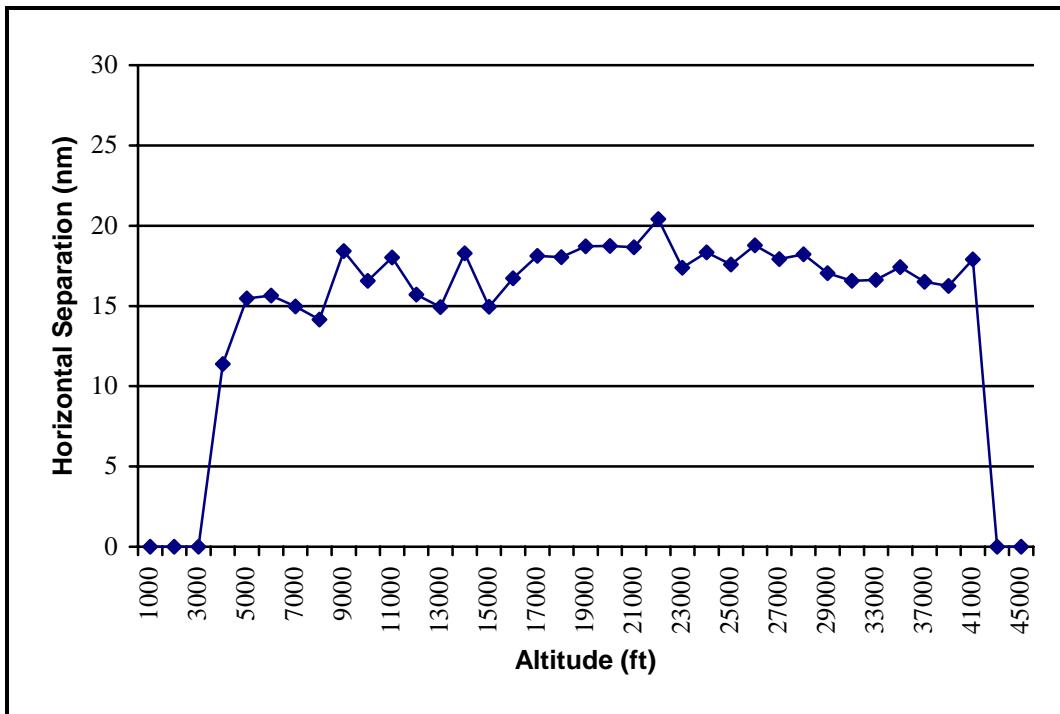


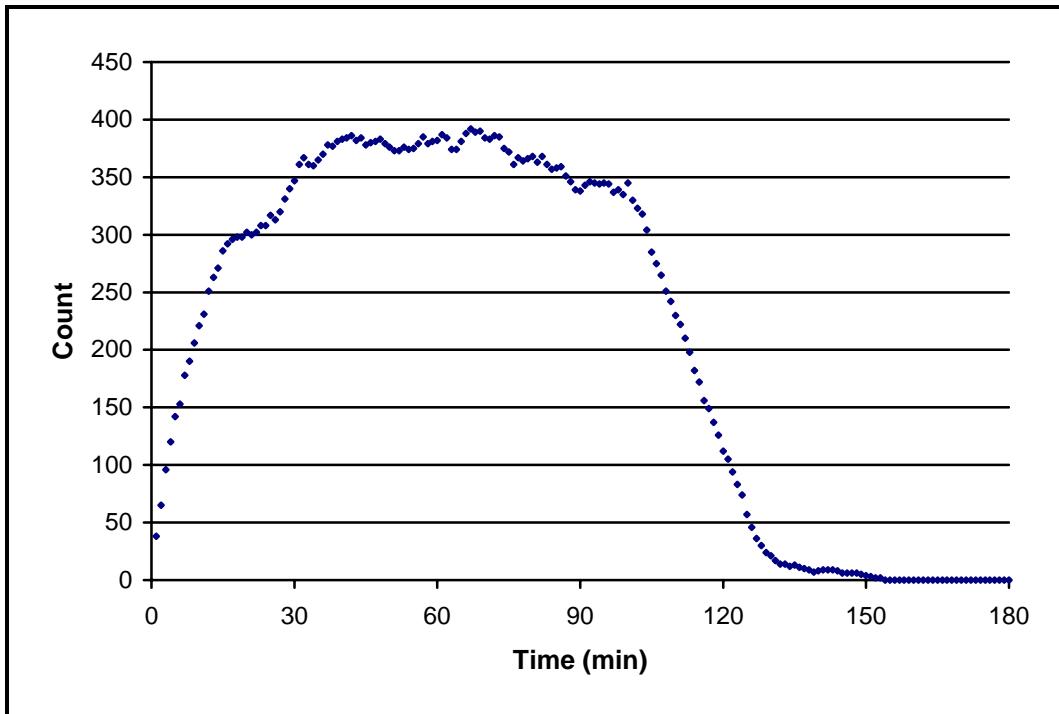
Figure 3: Average Horizontal Separation by Altitude for All Hours

## 6.2 Active Flights

This section corresponds to section 3.3.2 of Reference[1].

**Table 10: Statistics on Active Flights per Minute Increment**

Count Average	Standard Deviation	Maximum Count	Minimum Count
213.644	158.581	392	0



**Figure 4: Count of Active Flights per Minute Increment**

### 6.3 Flight Type and Sector Penetration

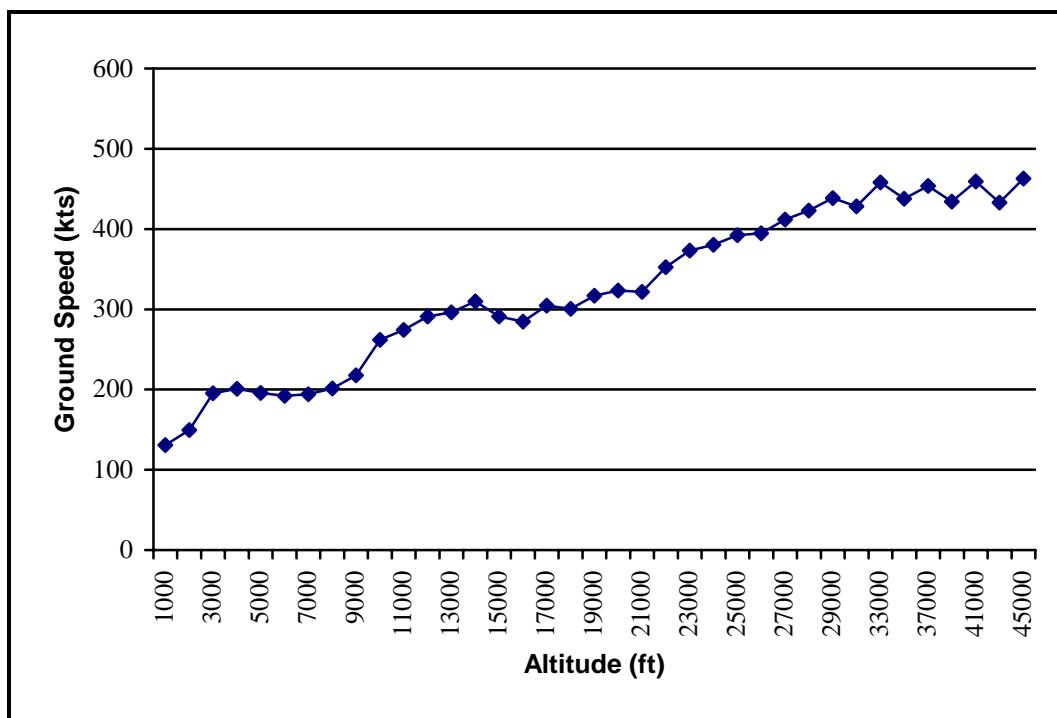
This section corresponds to Section 3.3.3 of Reference[1].

**Table 11: Statistics on Sector Time, Center Time and Sector Penetration by Flight Type**

Metric	Arrivals	Departures	Internals	Overflights	All Flights
Average Number of Sectors Penetrated	2.399	2.459	2.464	2.588	2.460
Average Time in Center (sec)	1212.292	1220.179	1219.244	1573.824	1238.630
Average Time in Sector (sec)	494.876	484.840	488.901	593.864	495.066
Percentage by Flight Type	20.032	22.090	52.336	5.384	100.000

### 6.4 Ground Speed

This section corresponds to Section 3.3.4 of Reference[1]. Detailed statistics on aircraft ground speed are provided in Appendix B.



**Figure 5: Average Ground Speed by Altitude for All Hours**

## 6.5 Center to APD Ratio

This section corresponds to Section 3.3.5 of Reference[1].

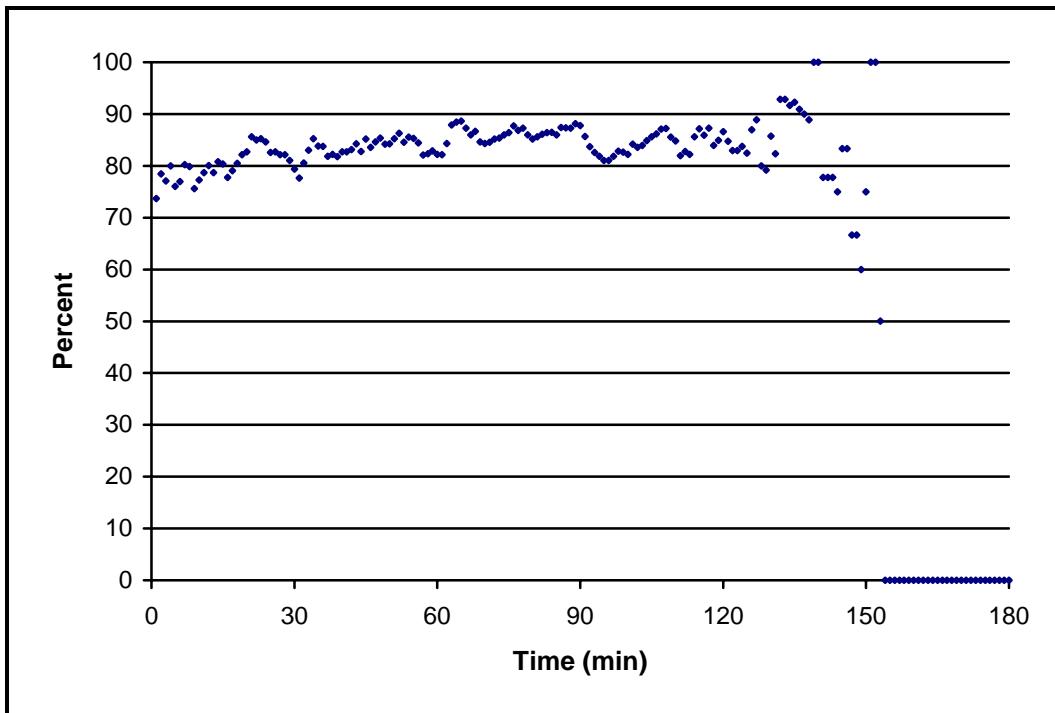


Figure 6: Percentage of Track Points in Center to APD Zone per Minute Increment

## 6.6 Interim Altitude Messages

This section corresponds to Section 3.3.6 of Reference[1].

Table 12: Statistics on Interim Altitude Messages<sup>5</sup>

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
831	2.708	1.004	7	1

## 6.7 Amendment Messages

This section corresponds to Section 3.3.7 of Reference[1]

Table 13: Statistics on Amendment Messages per Flight<sup>6</sup>

Flight Count	Average	Standard Deviation	Maximum Count	Minimum Count
775	2.485	1.583	11	1

<sup>5</sup> Statistics on flights with interim altitude messages only

<sup>6</sup> Statistics on flights with flight plan amendments only

## 6.8 Air Traffic Maneuvers

This section corresponds to Section 3.3.8 of Reference[1]. Detailed statistics on air traffic maneuvers are provided in Appendix C.

**Table 14: Total Track Report Maneuver Count by Vertical and Horizontal Phase of Flight**

Vertical Phase	Horizontal Phase of Flight		Total
	STR	TURN	
ASC	9623	1850	11473
DES	9121	1713	10834
LEV	2571	1372	3943
Total	21315	4935	26250

**Table 15: Percent breakdown of Flight Tracks by Vertical and Horizontal Phase**

Vertical Phase	Horizontal Phase of Flight		Margin (%)
	STR (%)	TURN (%)	
ASC	36.659	7.048	43.707
DES	34.747	6.526	41.272
LEV	9.794	5.227	15.021
Margin (%)	81.200	18.800	100.000

## 7 Aircraft Distributions

This sections provides the metrics used to characterize the aircraft provided in the scenario. The selected metrics are aircraft type, model, navigational equipment, and the air carriers operating in the airspace. The section corresponds to Section 3.4 of Reference[1].

### 7.1 Aircraft Type

This section corresponds to Section 3.4.1 of Reference[1].

**Table 16: Count by Aircraft Type**

Aircraft Type	Count	Percentage of Total
J	782	76.367
P	40	3.906
T	189	18.457
Unknown	13	1.270
Total	1024	100.000

## 7.2 Aircraft Models

This section corresponds to Section 3.4.2 of Reference[1]. A full listing and count of aircraft models is provided in Appendix D.

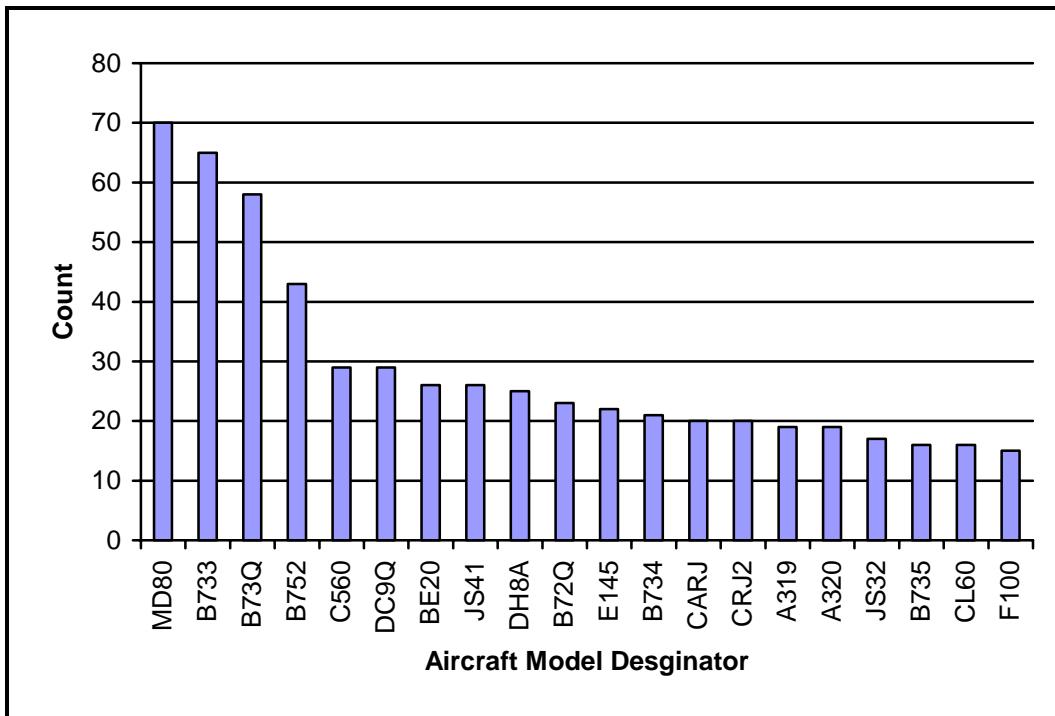


Figure 7: Count of Top Twenty Aircraft Models

### **7.3 Navigational Equipage**

This section corresponds to Section 3.4.3 of Reference[1].

**Table 17: Count by Aircraft Navigational Equipage Type**

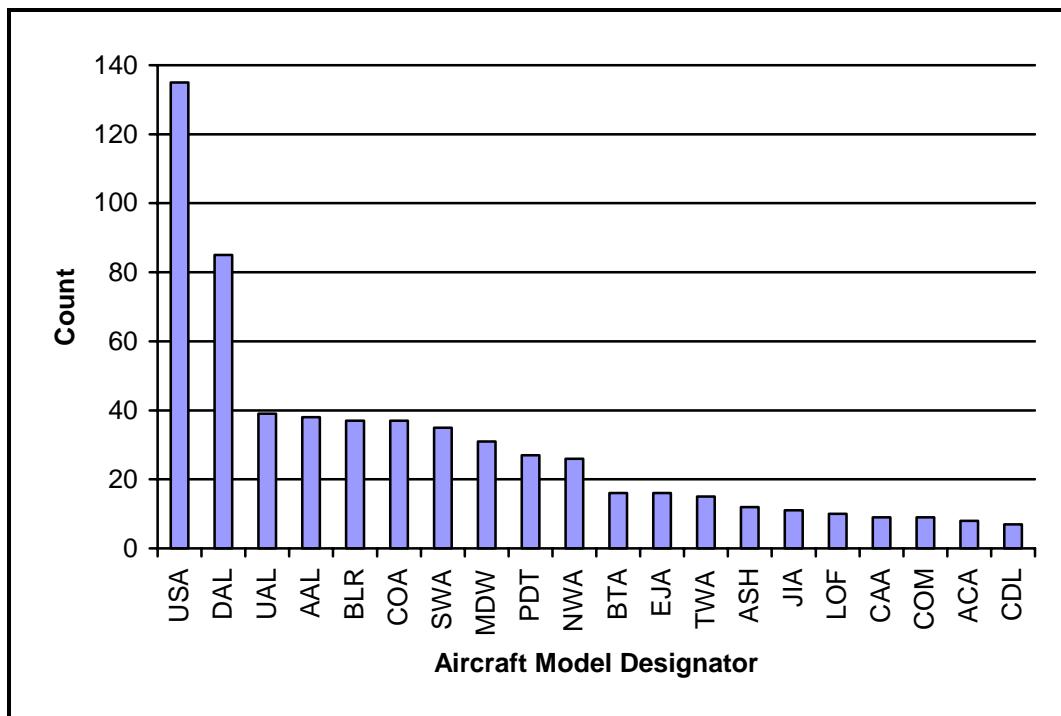
Nav. Equip. Designator	Count	Percentage of total
A	220	21.484
F	192	18.750
G	190	18.555
I	185	18.066
E	149	14.551
R	44	4.297
W	26	2.539
P	8	0.781
Q	5	0.488
U	5	0.488
Total	1024	100.000

## 7.4 Carrier Distribution

This section corresponds to Section 3.4.4 of Reference[1].

**Table 18: Count by Carrier Type**

Category	Count	Percentage of Total
Commercial	723	70.605
General Aviation	235	22.949
Other <sup>7</sup>	66	6.445
Total	1024	100.000



**Figure 8: Count by Top Twenty Air Carriers**

<sup>7</sup> Includes military and aircraft with unrecognized designators

## 8 Flight Plan Adherence

This section provides statistics on lateral and vertical flight plan adherence and corresponds to Section 3.5 of Reference[1].

### 8.1 Lateral Flight Plan Adherence

This section corresponds to Section 3.5.1 of Reference[1].

**Table 19: Statistics on Lateral Flight Plan Adherence by Altitude<sup>8</sup>**

Upper Altitude (ft)	Flight Count	Max. Dist. Out (nm)	Min. Dist. Out (nm)	Average Dist. Out (nm)	Standard Dev.(nm)
10000	67	39.872	11.004	19.859	8.372
18000	29	59.616	13.053	19.002	5.351
33000	45	38.733	13.015	24.372	6.009
45000	26	58.114	19.009	26.832	7.188
Total	167				

### 8.2 Vertical Flight Plan Adherence

This section corresponds to Section 3.5.2 of Reference[1].

**Table 20: Statistics on Vertical Flight Plan Adherence by Altitude<sup>9</sup>**

Upper Altitude (ft)	Flight Count	Max. Dist. Out (ft)	Min. Dist. Out (ft)	Average Dist. Out (ft)	Standard Dev.(ft)
29000	605	36100	308	5133.196	4422.423
45000	224	20000	600	4250.891	3084.208
Total	829				

<sup>8</sup> Statistics determined on tracks out of lateral adherence only.

<sup>9</sup> Statistics were determined on tracks out of vertical adherence only.

## Appendix A: Supplement to Section 6.1 - Aircraft Traffic Density

**Table 21: Statistics on Aircraft Encounters by Altitude Interval for All Hours**

Upper Altitude (ft)	Aircraft Count	Avg. Horz. Sep.(nm)	Standard Dev.(nm)
1000	0	0.000	0.000
2000	0	0.000	0.000
3000	0	0.000	0.000
4000	4	11.389	8.265
5000	6	15.470	9.928
6000	9	15.639	10.156
7000	14	14.966	8.408
8000	11	14.158	9.680
9000	11	18.418	8.064
10000	5	16.570	6.374
11000	24	18.020	7.871
12000	27	15.707	7.768
13000	49	14.937	7.871
14000	25	18.278	5.317
15000	141	14.956	8.490
16000	104	16.732	7.151
17000	79	18.113	6.551
18000	89	18.036	7.835
19000	112	18.724	7.181
20000	99	18.740	6.935
21000	97	18.664	6.835
22000	89	20.418	7.044
23000	89	17.383	7.421
24000	103	18.331	7.377
25000	115	17.589	7.875
26000	71	18.786	7.213
27000	72	17.914	7.868
28000	106	18.220	7.789
29000	136	17.052	7.759
31000	301	16.573	8.245
33000	381	16.632	7.852
35000	292	17.430	7.853
37000	83	16.513	7.111
39000	23	16.245	7.986
41000	14	17.895	7.943
43000	0	0.000	0.000
45000	0	0.000	0.000
Total	2781		

## Appendix B: Supplement to Section 6.4 - Aircraft Ground Speed

**Table 22: Statistics on Ground Speed by Altitude for All Hours**

Upper Altitude (ft)	Distinct Aircraft	Average Speed (kts)	Standard Dev.(kts)
1000	6	130.895	66.280
2000	36	149.525	40.176
3000	118	195.223	56.064
4000	235	200.736	51.618
5000	354	195.718	56.003
6000	456	191.991	51.269
7000	540	194.030	54.038
8000	585	201.497	54.470
9000	663	217.797	56.842
10000	727	261.757	62.632
11000	784	274.453	59.208
12000	798	291.145	64.860
13000	791	296.277	69.721
14000	783	309.675	74.380
15000	779	290.912	79.939
16000	774	284.677	79.119
17000	749	304.703	78.394
18000	727	300.675	82.830
19000	719	316.757	77.378
20000	702	323.304	79.878
21000	692	321.571	84.887
22000	667	352.429	81.694
23000	651	373.123	76.264
24000	638	380.414	75.009
25000	613	392.303	81.055
26000	590	394.789	75.605
27000	578	411.792	58.951
28000	552	423.009	54.846
29000	513	438.614	52.937
31000	500	428.114	51.558
33000	420	458.126	43.899
35000	312	437.585	40.958
37000	157	453.584	48.537
39000	95	433.956	46.807
41000	43	459.294	44.033
43000	11	432.762	22.257
45000	3	462.774	40.306

## Appendix C: Supplement to Section 6.8 - Air Traffic Maneuvers

**Table 23: Count of Maneuvers by Altitude, Vertical and Horizontal Phase of Flight**

Upper Altitude (ft)	Vertical Phase	Horizontal Phase of Flight	
		STR	TURN
1000	ASC	3	4
	DES	1	1
	LEV	3	3
2000	ASC	12	20
	DES	2	2
	LEV	23	25
3000	ASC	43	47
	DES	20	14
	LEV	70	63
4000	ASC	59	54
	DES	57	40
	LEV	129	91
5000	ASC	70	64
	DES	102	97
	LEV	194	110
6000	ASC	72	51
	DES	148	120
	LEV	232	112
7000	ASC	72	47
	DES	197	123
	LEV	283	121
8000	ASC	71	40
	DES	230	115
	LEV	317	127
9000	ASC	73	63
	DES	289	105
	LEV	343	123
10000	ASC	74	47
	DES	373	152
	LEV	360	132
11000	ASC	138	41
	DES	442	181
	LEV	382	137
12000	ASC	138	53
	DES	444	138
	LEV	393	92

13000	ASC	63	28
	DES	443	91
	LEV	389	43
14000	ASC	47	11
	DES	439	82
	LEV	382	38
15000	ASC	32	19
	DES	445	70
	LEV	382	35
16000	ASC	52	25
	DES	443	53
	LEV	364	36
17000	ASC	43	28
	DES	427	50
	LEV	355	32
18000	ASC	38	20
	DES	418	51
	LEV	350	28
19000	ASC	39	14
	DES	399	46
	LEV	346	39
20000	ASC	26	13
	DES	402	31
	LEV	348	36
21000	ASC	38	20
	DES	396	24
	LEV	340	20
22000	ASC	38	17
	DES	381	19
	LEV	333	26
23000	ASC	43	18
	DES	366	23
	LEV	325	34
24000	ASC	114	33
	DES	360	21
	LEV	320	33
25000	ASC	50	27
	DES	347	24
	LEV	310	23
26000	ASC	33	11
	DES	336	25

	LEV	300	19
27000	ASC	65	26
	DES	323	24
	LEV	295	27
28000	ASC	90	38
	DES	316	21
	LEV	278	24
29000	ASC	133	46
	DES	290	16
	LEV	259	16
31000	ASC	188	95
	DES	272	21
	LEV	244	28
33000	ASC	200	113
	DES	213	21
	LEV	213	20
35000	ASC	207	122
	DES	157	17
	LEV	134	11
37000	ASC	99	52
	DES	74	13
	LEV	69	6
39000	ASC	60	35
	DES	44	12
	LEV	32	0
41000	ASC	36	22
	DES	16	4
	LEV	22	3
43000	ASC	9	5
	DES	8	2
	LEV	2	0
45000	ASC	3	3
	DES	3	1
	LEV	0	0

## Appendix D: Supplement to Section 7.2 - Aircraft Models

**Table 24: Count and Percentage of Aircraft by Model Type**

Model Type	Aircraft Count	Percent of Total
MD80	70	6.836
B733	65	6.348
B73Q	58	5.664
B752	43	4.199
C560	29	2.832
DC9Q	29	2.832
BE20	26	2.539
JS41	26	2.539
DH8A	25	2.441
B72Q	23	2.246
E145	22	2.148
B734	21	2.051
CARJ	20	1.953
CRJ2	20	1.953
A319	19	1.855
A320	19	1.855
JS32	17	1.660
B735	16	1.563
CL60	16	1.563
F100	15	1.465
C650	14	1.367
LJ35	14	1.367
B737	13	1.270
B763	13	1.270
CRJ1	13	1.270
SF34	13	1.270
B190	11	1.074
D328	11	1.074
H25B	11	1.074
C550	10	0.977
B722	9	0.879
B738	9	0.879
B762	9	0.879
BE9L	9	0.879
DC9	9	0.879
GLF4	9	0.879
B772	8	0.781

BE58	8	0.781
F15	7	0.684
LJ31	7	0.684
LJ60	7	0.684
E135	6	0.586
BE40	5	0.488
C210	5	0.488
C421	5	0.488
DH8B	5	0.488
E120	5	0.488
FA20	5	0.488
GLF2	5	0.488
LJ25	5	0.488
WW24	5	0.488
B350	4	0.391
B744	4	0.391
C130	4	0.391
C750	4	0.391
F16	4	0.391
F2TH	4	0.391
GLF3	4	0.391
H25C	4	0.391
J328	4	0.391
LJ24	4	0.391
A330	3	0.293
ASTR	3	0.293
AT43	3	0.293
B732	3	0.293
BE10	3	0.293
BE30	3	0.293
BE36	3	0.293
C5	3	0.293
E2	3	0.293
F18	3	0.293
F900	3	0.293
FA50	3	0.293
LJ55	3	0.293
MD11	3	0.293
S3	3	0.293
n/a	3	0.293
A306	2	0.195
AC90	2	0.195

B721	2	0.195
B727	2	0.195
BE33	2	0.195
C141	2	0.195
C172	2	0.195
C182	2	0.195
C2	2	0.195
C441	2	0.195
C500	2	0.195
C525	2	0.195
CL64	2	0.195
DC10	2	0.195
DH8C	2	0.195
F28	2	0.195
JS31	2	0.195
LJ36	2	0.195
LJ45	2	0.195
LR31	2	0.195
PA32	2	0.195
PAY1	2	0.195
PAY2	2	0.195
PAY3	2	0.195
SBR1	2	0.195
A340	1	0.098
AT72	1	0.098
B712	1	0.098
B72G	1	0.098
B741	1	0.098
B742	1	0.098
B757	1	0.098
BD9L	1	0.098
BE90	1	0.098
BE9F	1	0.098
BE9T	1	0.098
C135	1	0.098
C206	1	0.098
C340	1	0.098
C402	1	0.098
C501	1	0.098
DA50	1	0.098
E2C	1	0.098
E3TF	1	0.098

EA6	1	0.098
FA90	1	0.098
G3	1	0.098
GLF5	1	0.098
H25A	1	0.098
HS25	1	0.098
K35R	1	0.098
LR25	1	0.098
LR35	1	0.098
M20P	1	0.098
MD90	1	0.098
MU30	1	0.098
P180	1	0.098
P28R	1	0.098
P3	1	0.098
P32R	1	0.098
PA27	1	0.098
PA28	1	0.098
PA31	1	0.098
PA34	1	0.098
PA46	1	0.098
S3B	1	0.098
T70	1	0.098
Total	1024	100.000